The History of Life

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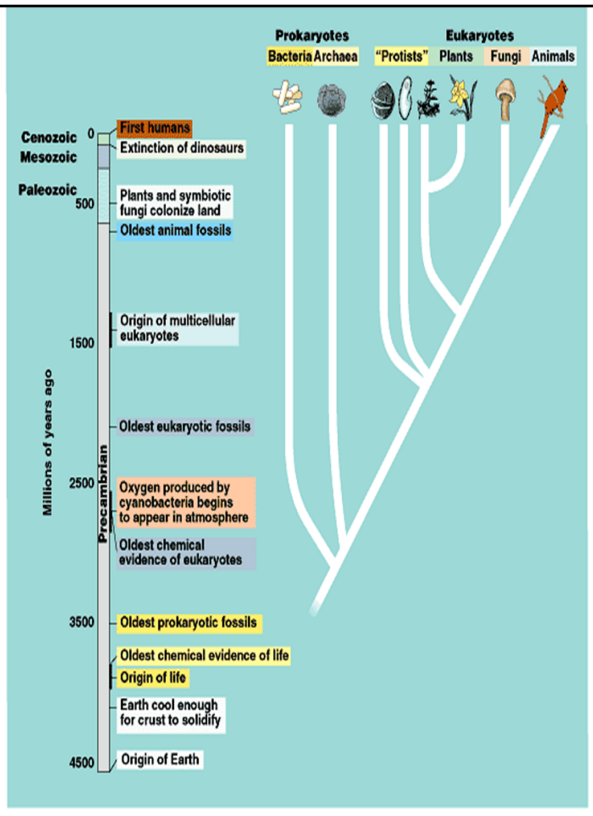
The history of life on Earth is a amazing and complex story.

One technique used to study the history of life on Earth is to observe the fossil record.

Paleontologists are scientists who collect and study fossils giving us a glimpse into our past.



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Geologic evidence shows that the Earth was formed approximately 4.6 billion years ago.

Early Earth was very different from Earth today.
Early Earth Conditions
- pinkish-orange sky bombarded with lightning
- very hot
- surface was mostly barren rock and volcanoes
- atmosphere was composed of hydrogen cyanide, methane, ammonia, carbon dioxide, carbon monoxide, nitrogen and water

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Eventually the Earth cooled enough for water to remain in liquid form allowing for the formation of oceans over much of the surface of the Earth.

But was this change enough to stimulate the formation of life on Earth??? Or were the conditions still to harsh???

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Requirements for **Chemical Evolution** to produce life:

- absence of O_2
- energy
- chemical building blocks
- time

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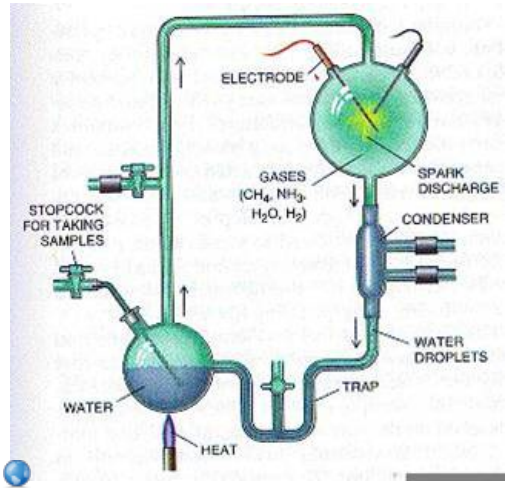
Miller and Urey

In the 1950's Stanley Miller and Harold Urey tried to answer those questions by simulating the early conditions in the controlled environment of their lab.

Over a few days amino acids (the building blocks of protein) began to accumulate.



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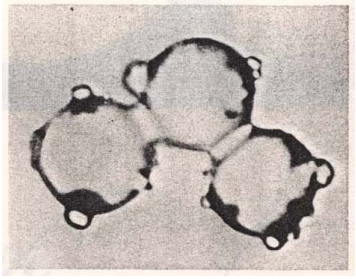
The Leap from Molecules to Cells



The biggest gap in scientific hypotheses about Earth's early history is the leap from nonlife to life.

Tiny bubbles known as **Proteinoid Microspheres** may hold the answer to this problem. It is believed that early molecules came together to form these microspheres.

- Microspheres are not cells but they do have some of the characteristics of living systems (selectively permeable membrane, can store and release energy,)

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From Proteinoid Microspheres to Cells

Scientists believe that these abiotic microspheres continued to obtain the characteristics of living cells and approximately 3.5 billion years ago evolved into the first cell.

Primordial Soup

Ingredients:
One ocean of water
Sunlight (as available)
Organic materials from space: amino acids, fatty acids, polycyclic aromatic hydrocarbons, other hydrocarbons as neeed

Dissolve organic materials in ocean, let simmer in sunlight for up to a billion years. Makes large numbers of prebiotic cells.

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Characteristics of the first cell

- unicellular
- aquatic
- prokaryotic (RNA)
- anaerobic (Earth's atmosphere originally contained very little oxygen)

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2.2 Billion Years Ago

Early photosynthetic cells were steadily producing oxygen causing oxygen to accumulate in the atmosphere.

To early cells oxygen was poisonous. Some early life forms died out while others evolved to use oxygen for respiration. (Remember that aerobic respiration produces more energy than anaerobic respiration - allowing for the development of larger cells)

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Origins of Eukaryotic Cells

About 2 billion years ago early prokaryotic cells began to evolve internal cell membranes creating the ancestor of all eukaryotes.

It is thought that this ancestral eukaryote engulfed another prokaryotic cell and together they developed a symbiotic relationship.

Endosymbiotic Theory - eukaryotic cells were created by the joining of several groups of prokaryotic cells. One group had the ability to use oxygen to create energy (becoming the mitochondria of the modern cell) while another group carried out photosynthesis to create energy (becoming the chloroplast of the modern cell)

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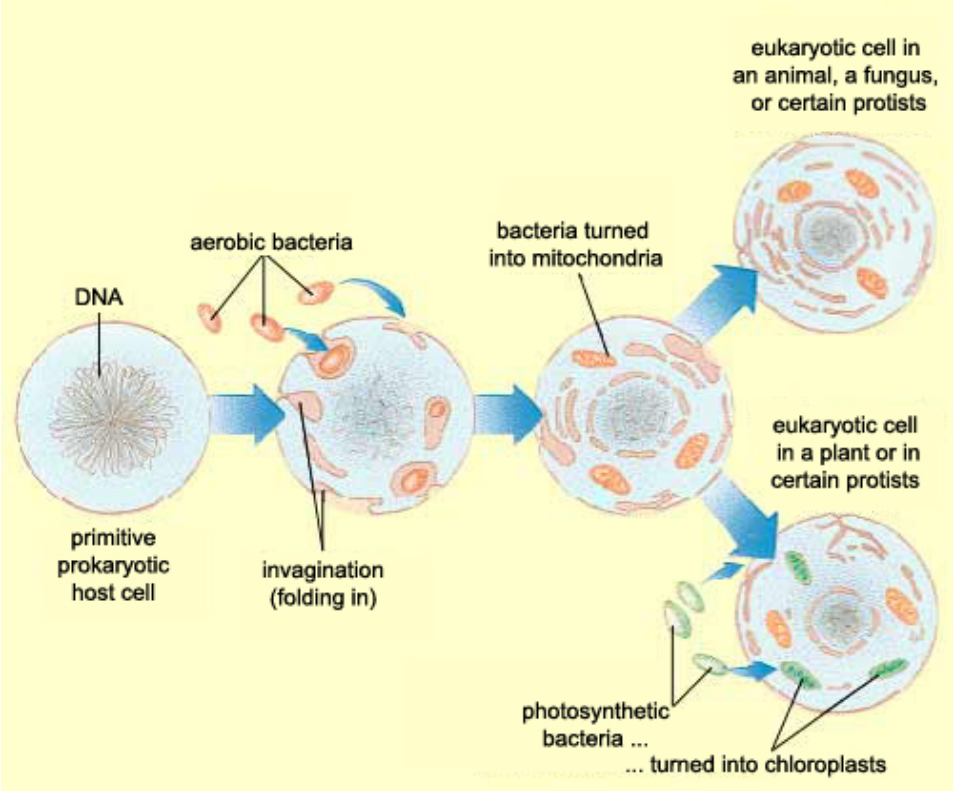

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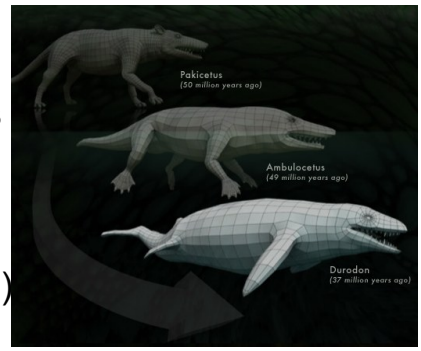
What Happened Next??

- aquatic multicellularity

- as early as 2 billion years ago cells stopped going their separate ways after replicating and evolved specialized functions.
- development of various aquatic life forms.



- terrestrial autotrophs

- Some of these early aquatic life forms eventually started to venture to land, giving rise to modern day tetrapods. Many body changes had to occur for this to happen (ex. loss of gills and fins)

- terrestrial heterotrophs

- As more species began to make their homes on land, changes in diet patterns began to occur.

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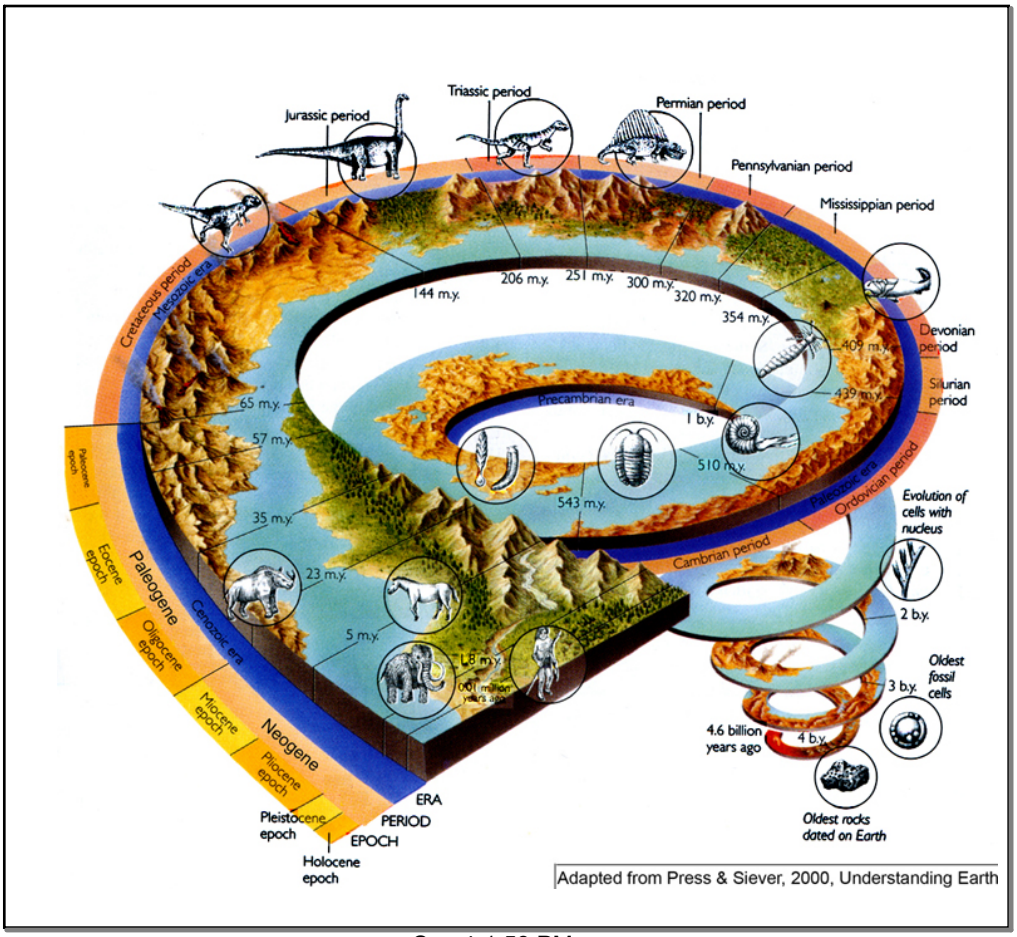

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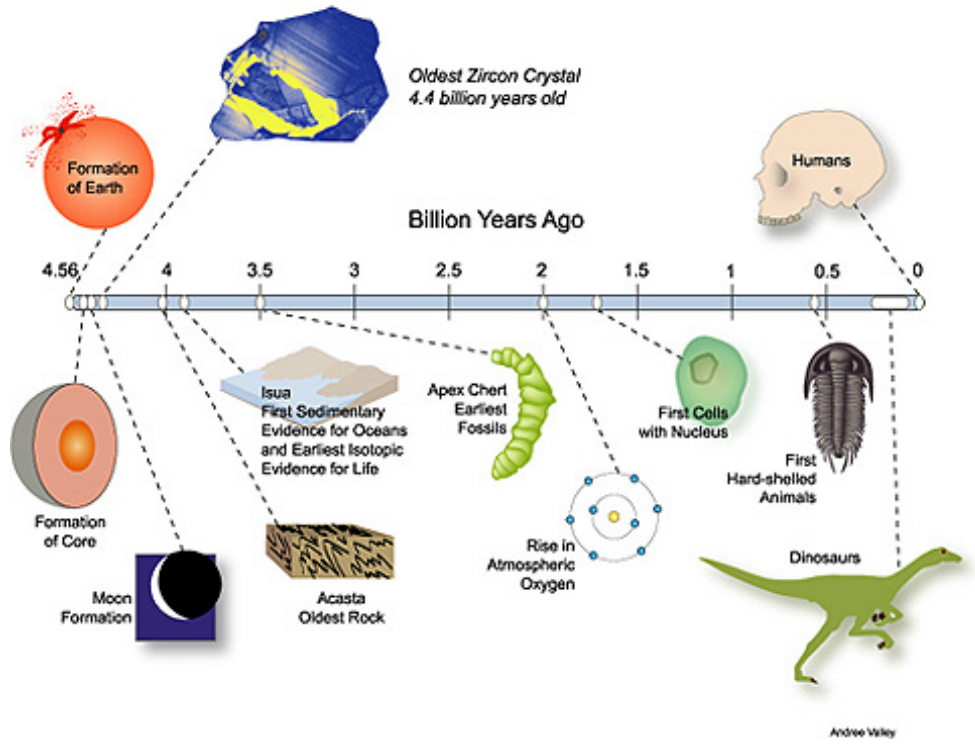

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Assignment 1

Using section 17-3 (pages 429 - 434) create a time line outlining the major events that have occurred in Earth's history.

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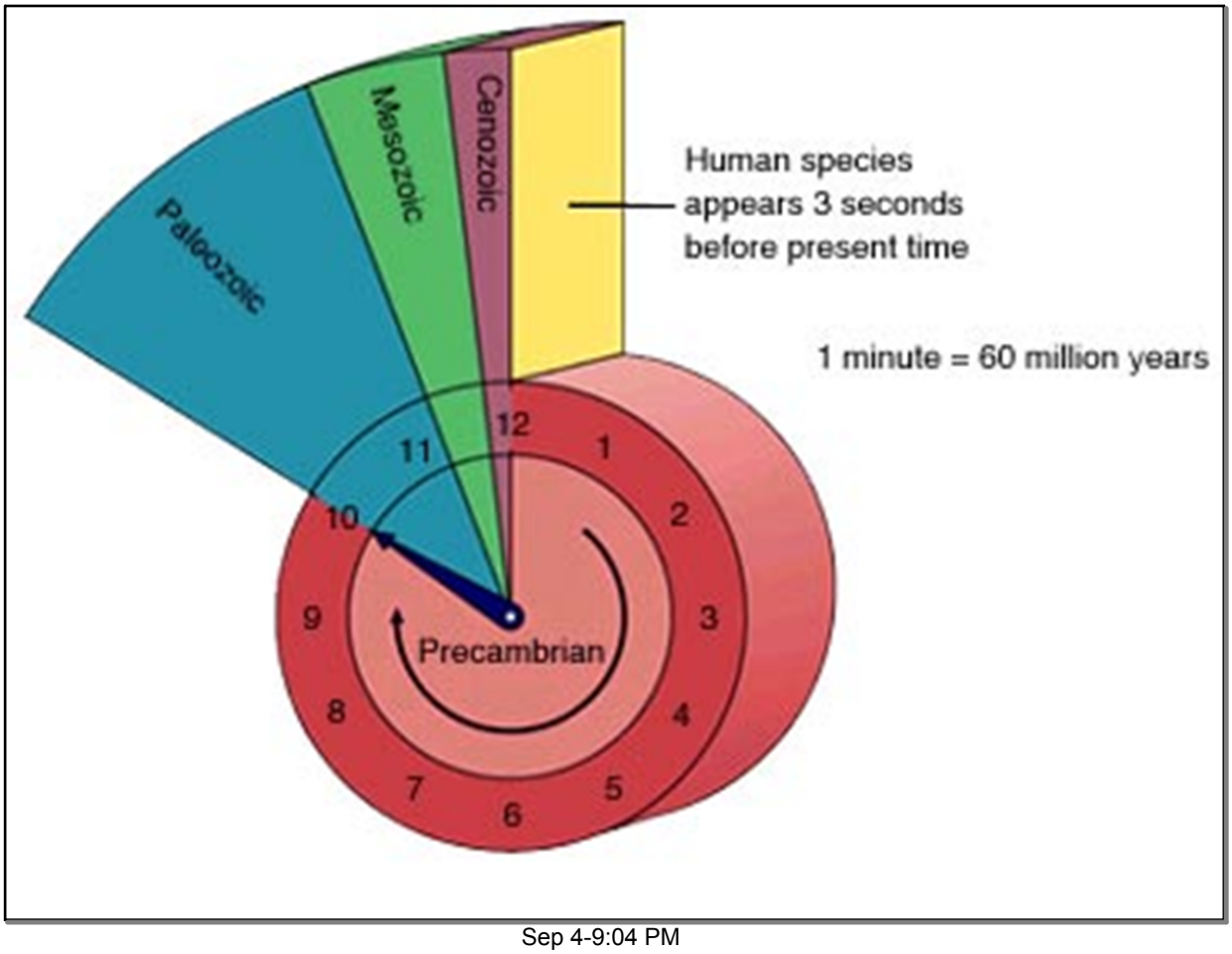

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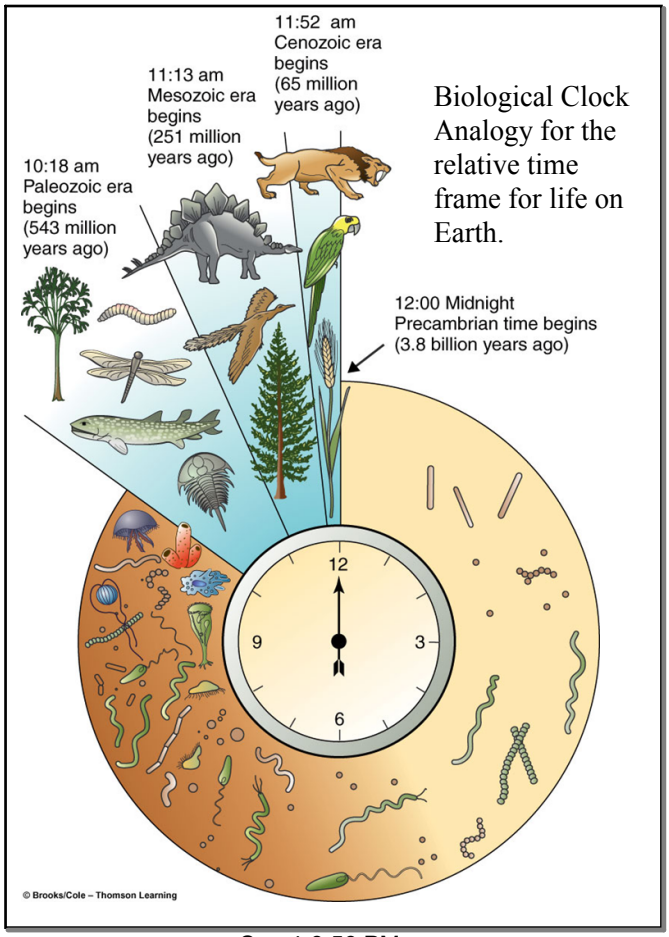

Biological Clock Analogy for the relative time frame for life on Earth.

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